ECGN – European Combined Geodetic Network
The EUREF Contribution to GGOS

Height is an ambiguous word in geodesy. Ellipsoidal height is purely geometrical and can be measured e.g. by navigation satellites like GPS. Physical heights, labelled as heights above sea level, refer to a boundary of the gravity potential. They are derived from a combination of geometric and gravity measurements. The combination of these systems is not trivial. The ECGN project is trying to use control points like the Conrad Observatory which offer the opportunity to check the different heights with geometrical and physical methods in a very accurate way. Such a permanent station can also monitor height changes in time.

The ECGN project was initiated by the International Association of Geodesy/IAG. There is a need for increased accuracy in 3D positions which the realizations of reference systems must provide about ten times better than the usual applications referring to them. The simple equation
h = H + N (h ellipsoidal height, H physical height, N geoidal height) becomes complicated when all three components must have the same accuracy level. Measuring the ellipsoidal and physical heights at the millimetre level requires the application of very concise models to remove physical effects like those of the atmosphere and ground water levels. The geoidal height at presence, derived by astronomical, satellite and gravity measurements, has not yet reached the centimetre level. Each height has also a time-dependent component. At the time of the measurements the related reference like the Earth's crust is not the same. Additionally the sea level is not constant at different locations, like the Atlantic and the Mediterranean Sea. ECGN is intending to bring all observations together and to analyze them for systematic differences. The first stage is to collect data for all the control points (Figure 1) which are contributing. The main observations are GNSS data, levelling data, gravity data and tide gauge observations. It is assumed that not all observations are available at each control point. To these observations the corresponding metadata (e.g. also ground water levels, if available) and the local ties must be added. The first stage will result into a database of observations and metadata, together with retrieval and presentation functions.

At the second stage the comparison of the different results will take a prominent part. Comparison at the height level seems to be the best choice presently. Additionally time series comparison in the space and in the frequency domain is a useful tool to detect common influences of potential physical effects hitherto unknown.

Figure 1: Overview of candidate ECGN stations.

References:
http://www.bkg.bund.de/nn_167088/geodIS/ECGN/EN/Home/homepage__node.html__nnn=true

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